Assembling
and Using Your...

Heathkit

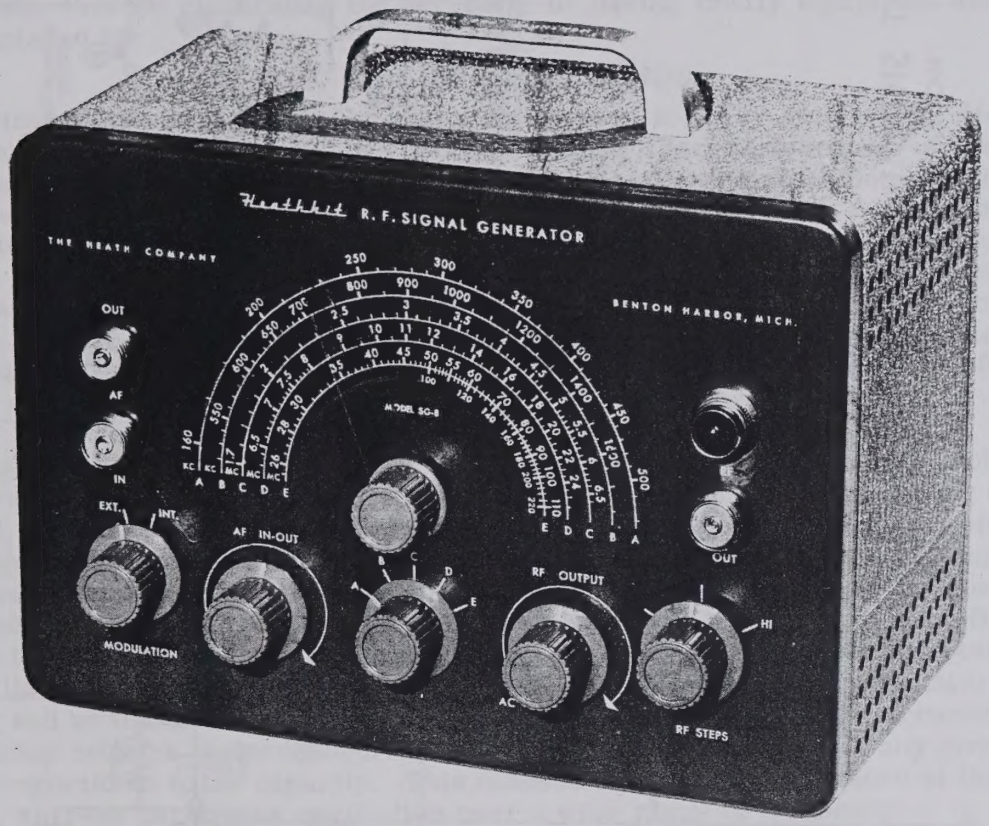
SIGNAL GENERATOR

MODEL SG-8

HEATH COMPANY
A Subsidiary of Daystrom Inc.
BENTON HARBOR, MICHIGAN

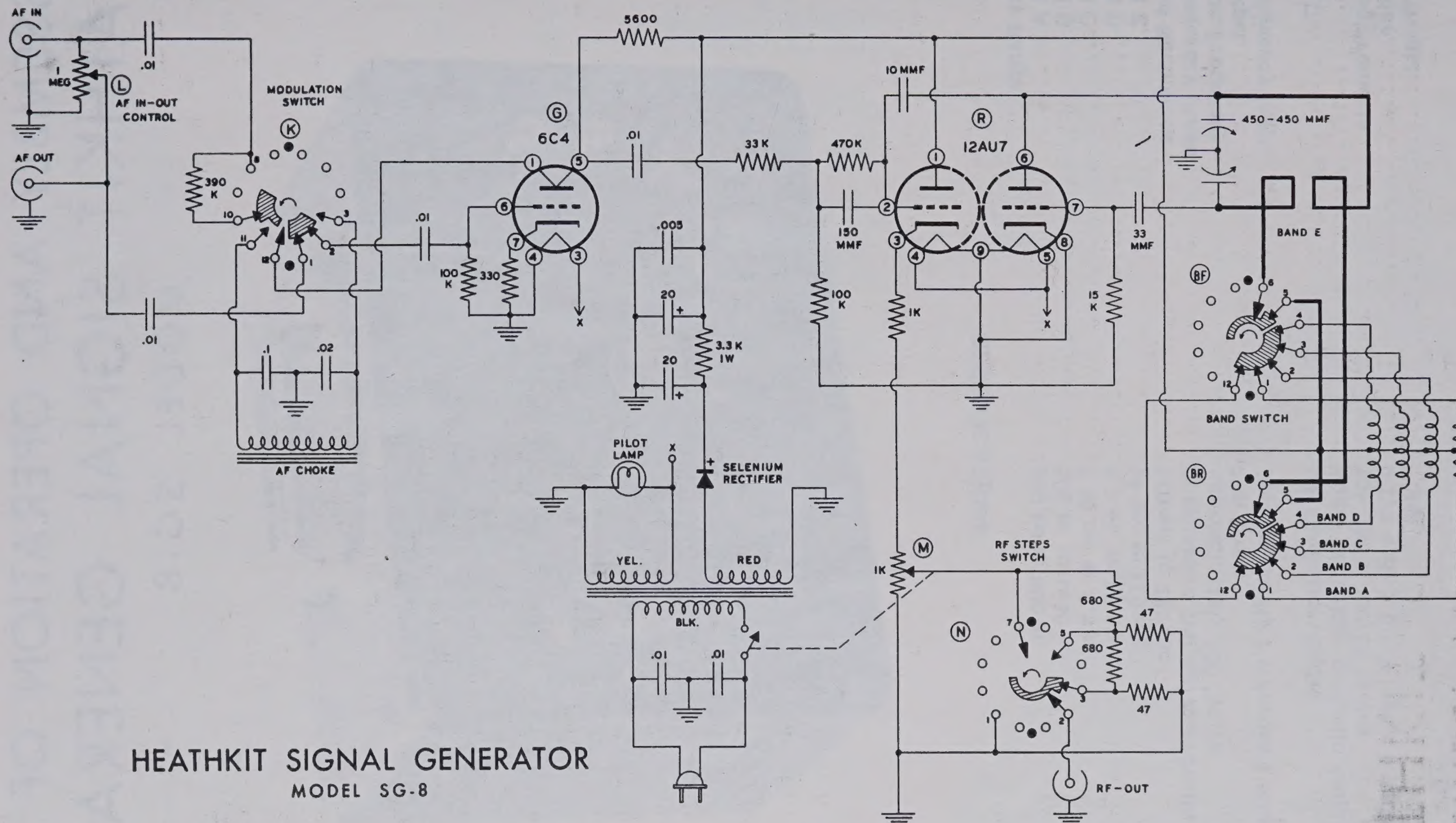
ASSEMBLY AND OPERATION OF THE HEATHKIT SIGNAL GENERATOR

MODEL SG-8



SPECIFICATIONS

Frequency Range	
Band A	160 kc to 500 kc
Band B	500 kc to 1650 kc
Band C	1.65 mc to 6.5 mc
Band D	6.5 mc to 25 mc
Band E	25 mc to 110 mc
Calibrated Harmonics	110 mc to 220 mc
Radio Frequency Output	In excess of 100,000 microvolts
Modulation Frequency	Approximately 400 cycles
Audio Output	2 to 3 volts
Audio Frequency Input	Approximately 5 v across 1 megohm
Tubes	
12AU7	RF Oscillator-Buffer
6C4	Audio Oscillator or Audio Amplifier
Power Requirements	105-125 v, 50/60 cycles
Cabinet Size	9 1/2 wide x 6 1/2 high x 5 deep
Shipping Weight	7 lbs.



HEATHKIT SIGNAL GENERATOR

MODEL SG-8

INTRODUCTION

The Heathkit model SG-8 Signal Generator has been designed for simplicity of construction and stability of operation. A little care taken during the process of construction will reward the kit builder with a signal generator which will give excellent performance and will be both pleasant and easy to use. This generator has been engineered so that it will be valuable to the radio repairman, ham and experimenter over a wide range of uses, in addition to being a rugged and highly dependable piece of test equipment. It is made with high quality parts, conservatively rated, and will give long and efficient service. The model SG-8 Signal Generator utilizes factory adjusted coils, thereby eliminating the necessity of having costly equipment available to calibrate the finished kit.

CIRCUIT DESCRIPTION

The RF portion of the SG-8 Signal Generator consists of a 12AU7 twin triode tube. One triode section of this tube is used as a Colpitts oscillator. The other triode section is used in a cathode follower type circuit and acts as a buffer between the oscillator and the output of the signal generator. Four inductances wound on forms comprise the coils for bands A, B, C and D. They are switched into the circuit by means of the band switch. The E band coil is unique in its construction insofar that the heavy buswire of which it is composed actually forms the connections between the band switch and the tuning condenser for all of the lower frequency coils. When the band switch is placed in E band position, a short is placed across the leads of the E band coils, thereby making it a closed circuit inductance which is capable of tuning from 25 to 100 megacycles.

In a Colpitts oscillator circuit, feedback necessary to maintain oscillations is obtained from a capacitive reactance divider across the inductance of the frequency determining circuit. In the model SG-8, a capacitive divider is obtained by the use of a split-stator condenser. The advantage of this will be made apparent from the following explanation. For example, take a capacitive divider composed of fixed capacities. As the frequency across the condensers is increased, the reactance of the condensers is decreased. Therefore, using a fixed capacitive divider, as the frequency is increased reactance would become lower until a point was reached where oscillations could no longer be maintained. By the use of a split-stator condenser for both tuning and as the divider network as the frequency is increased, the capacity of the condenser dividing network is decreased. The reactance of a condenser for any given frequency is inversely proportional to the capacity. This tends to maintain the reactance of the network fairly constant, thereby permitting oscillation over a wide range of frequency.

The use of the cathode follower as a buffer stage has the following advantage: The characteristics of a "cathode follower" are very low output impedance with an extremely high input impedance. The extremely high input impedance produces little or no loading on the oscillator circuit. The very low output impedance provides a very stable output from the signal generator. The effect is such that a varying load on the output of the signal generator will produce little or no frequency instability of the oscillator. The signal generator incorporates a step attenuator for coarse control of radio frequency output and a continuously variable attenuation circuit for fine control of the radio frequency output.

The audio oscillator is also a Colpitts circuit. By the use of the large inductance of an iron-core choke and relatively high capacity in the capacitive divider, it is made to oscillate at approximately 400 cycles. This type of oscillator was again chosen for its stability and purity of waveform. With the modulation switch in the INT. position, 400 cycles audio voltage is applied through a resistance network to the grid of the cathode follower stage. This audio voltage is impressed as an amplitude modulated signal upon the RF output from the cathode follower.

At the same time the audio voltage is also applied to the external audio connector marked OUT, and may be used as an audio signal source for testing amplifiers, etc. With the modulation switch in the EXT. position, any external audio source of any frequency may be used to modulate the RF output of the signal generator. The 6C4 audio oscillator tube then becomes an amplifier stage for the external signal.

The power supply consists of a transformer which furnishes filament voltage to the 6C4 and 12AU7 tubes, and effectively isolates the instrument from the AC line. A selenium rectifier is connected to one winding of the transformer producing half-wave rectification. An RC filter network changes the pulsed output from the rectifier to fairly pure DC. The 110 volt input has both sides bypassed to minimize the signal feeding back through the power lines.

A unique design feature is the convenient AF IN-OUT control, which adjusts audio input if external modulation is employed and likewise adjusts the AF output level when using the generator as a source of audio output.

PRELIMINARY INSTRUCTIONS AND NOTES

The Heathkit model SG-8 Signal Generator when constructed in accordance with the instructions in this manual, is a high-quality piece of test equipment, capable of years of trouble-free service. We therefore urge you to take the necessary time to assemble and wire the kit carefully. You will be rewarded with a neat appearing, well-built and dependable test oscillator.

This manual is supplied to assist you in every way to complete the signal generator with the least possible chance for error. We suggest that you take a few minutes now and read the entire manual through before any work is begun. This will enable you to proceed with the work much faster when construction is started. The large, fold-in pictorials are handy to attach to the wall above your work space. Their use will greatly simplify the construction of the kit. These diagrams are repeated in smaller form within the manual. We suggest that you retain the manual in your files for future reference, both in the use of the signal generator and for its maintenance.

UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with each part. Refer to the charts and other information shown on the inside covers of the manual to help you identify any parts about which there may be a question. If some shortage is found in checking the parts, please notify us promptly and return the inspection slip with your letter to us. Hardware items are counted by weight, and if a few are missing, please obtain them locally if at all possible.

Read the note on soldering on the inside of the back cover. Crimp all leads tightly to the terminal before soldering. Be sure both the lead and the terminal are free of wax, corrosion, or other foreign substances. Use only the best rosin core solder, preferably a type containing the new activated fluxes, such as Kester "Resin-Five," Ersin "Multicore," or similar types.

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

Resistors and condensers generally have a tolerance rating of ±20% unless otherwise stated in the parts list. Therefore a 100 KΩ resistor may test anywhere from 80 KΩ to 120 KΩ. (The letter K is commonly used to designate a multiplier of 1000.) Tolerances on condensers are generally even greater. Limits of +100% and -50% are common for electrolytic condensers. The parts furnished with your Heathkit have been specified so they may not adversely affect the operation of the finished signal generator.

In order to expedite delivery to you, we are occasionally forced to make minor substitutions of parts. Such substitutions are carefully checked before they are approved, and the parts supplied will work satisfactorily. By checking the parts list for resistors, for example, you may find that a 2.2 megohm resistor has been supplied in place of a 2 megohm as shown in the parts list. These changes are self-evident and are mentioned here only to prevent confusion in checking the contents of your kit.

We strongly urge that you follow the wiring and parts layout shown in the manual. The position

of wires and parts is extremely critical in circuits operating at high frequencies, and changes may seriously affect the characteristics or calibration of the signal generator.

STEP-BY-STEP ASSEMBLY INSTRUCTIONS

The following instructions are presented in a simple, logical, step-by-step sequence to enable you to complete your kit with the least possible confusion.

Be sure to read each step all the way through before starting. When a step is completed, check it off in the space provided. This makes it easy to resume construction after your work has been interrupted.

Leads on condensers, transformers, and resistors are generally much longer than they need be to make the indicated connections. In these cases, the excess leads should be cut off as the parts are added to the chassis. Not only does this make the wiring much neater but in radio frequency work, the excess length of leads may actually create tuned parasitic circuits at undesired frequencies.

NOTE: We suggest that you execute the following preparations before any work is started:

1. Select from the large fold-in pictorials included with the manual the diagram showing the phase of construction you are engaged in at the time. Attach this diagram to the wall above your work space.
2. After identifying the parts from the parts list, lay them out in a large shallow box so that they are readily accessible. This will save considerable time in construction.
3. Read thoroughly the assembly and wiring instructions on the inside rear cover of the manual and refer to the general information on both inside covers of the manual to identify the parts.

NOTE: In assembling the kit, use lockwashers under all nuts unless a solder lug is used. The 3-48 screws and nuts used in mounting the miniature tube sockets are the only exception to this rule.

Unless otherwise stated, 6-32 screws, lockwashers and nuts are used in mounting of parts. Wire is to be insulated unless otherwise specified. Insulated sleeving is to be used on bare wires when called for.

ASSEMBLY OF SUB-CHASSIS

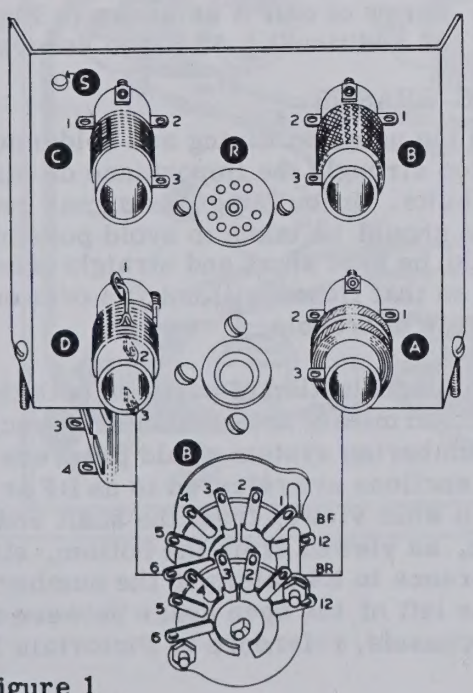


Figure 1

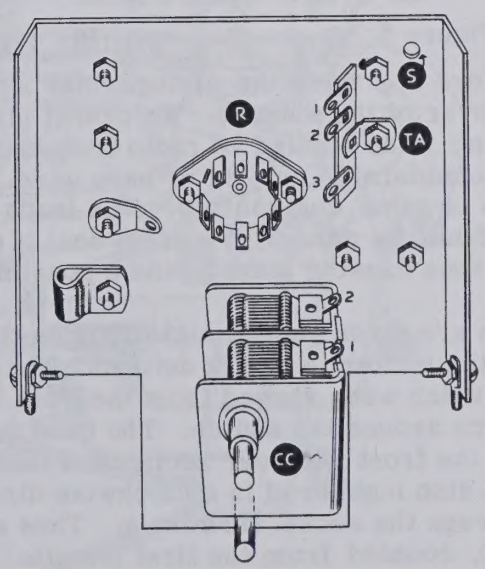


Figure 2

( ) Mount two 6-32 spade bolts on the sub-chassis aprons as shown in Figure 2. Method of mounting is shown in Figure 3.

( ) Mount a 9-pin miniature socket R on the sub-chassis, using 3-48 screws and nuts. Position as shown in Figures 1 and 2.

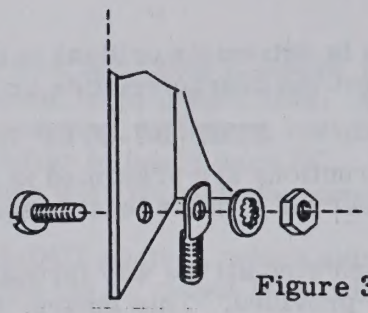


Figure 3

( ) Mount the tuning condenser as shown in Figures 1 and 2, using 3/16 6-32 screws with lockwashers under the heads.

( ) Mount the band switch B, using a control lockwasher and control nut. Omit the flat washer. Position as shown in Figure 2. See Figure 5 for method of mounting controls.

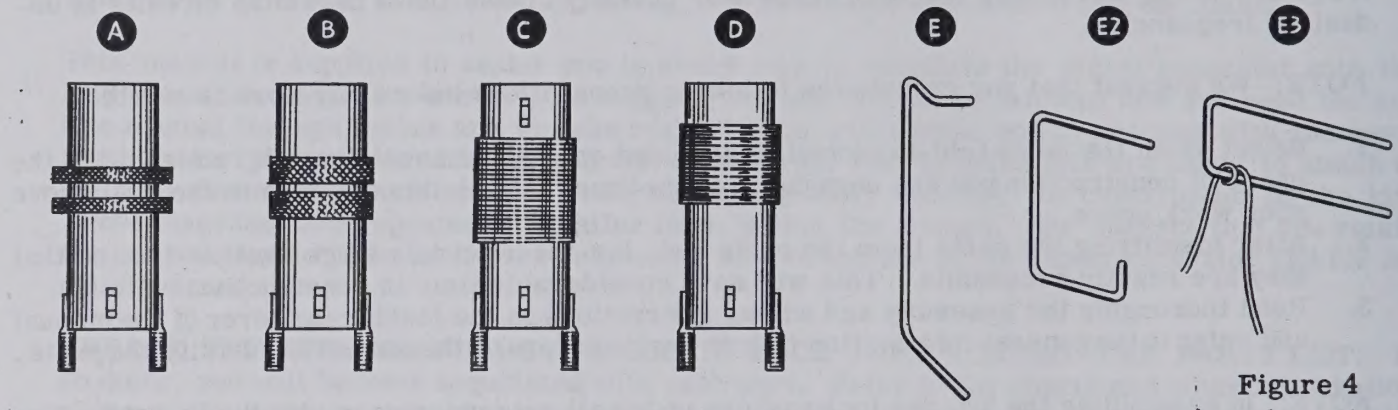


Figure 4

( ) Referring to Figure 4 for coil identification, and Figure 1 for coil position, mount the coils A, B, C and D. Referring to Figure 2, note that coil C has a 3-lug terminal strip mounted on its lower mounting screw, and coil A has a solder lug on its upper mounting screw. Use lockwashers on all coil mounting screws except the one having the solder lug.

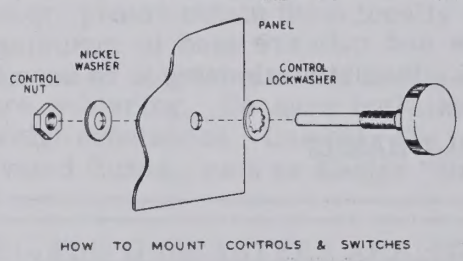


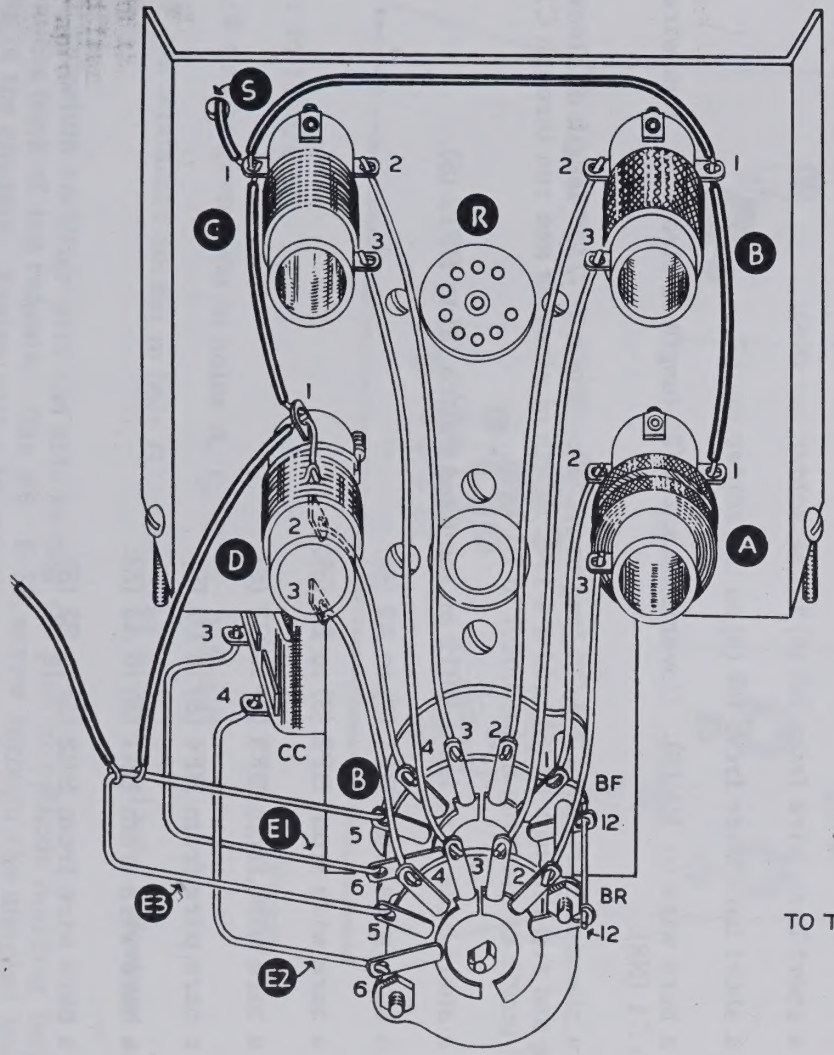
Figure 5

( ) Mount a cable clamp on the bottom mounting screw of coil A as shown in Figure 2, using an additional 6-32 nut to secure it.

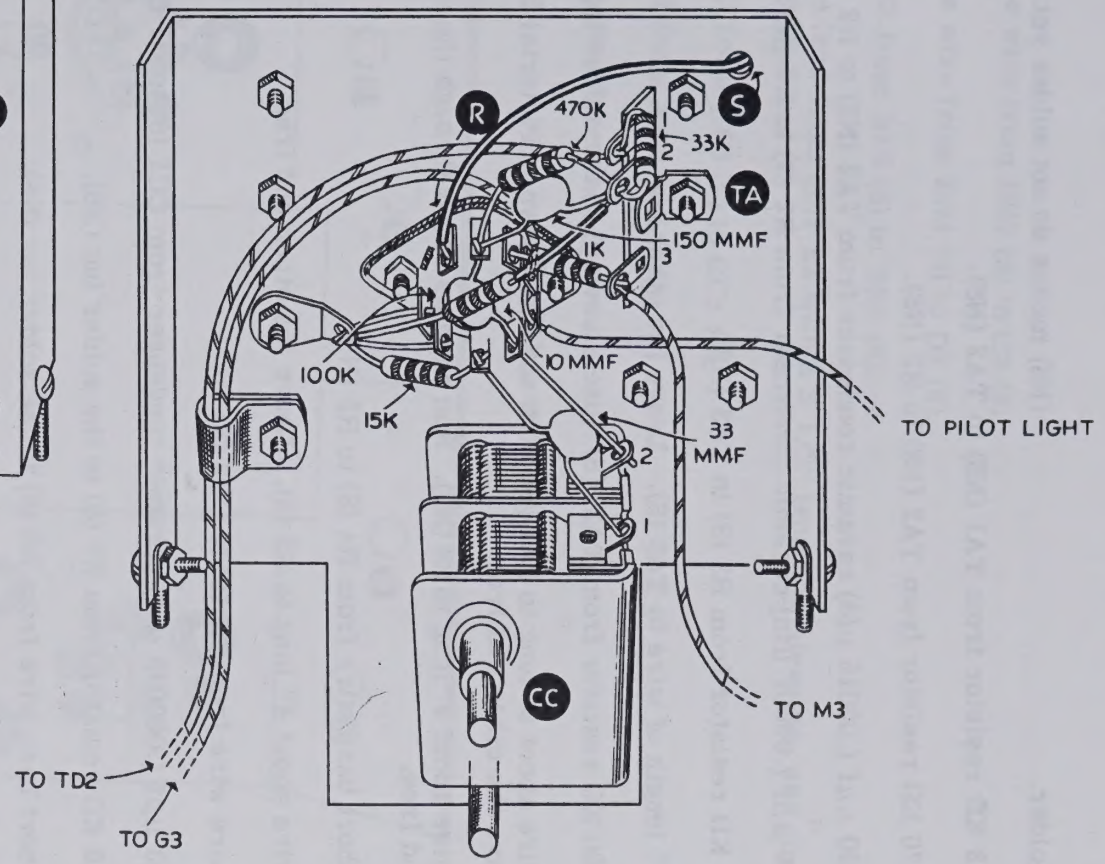
WIRING THE SUB-CHASSIS

NOTE: Before beginning the wiring, refer again to the notes on wiring and soldering on the inside rear cover of the manual. We cannot stress too strongly the importance of careful wiring and soldering when applied to radio frequency circuits. In building this signal generator you will use a considerable amount of bare wire. Care should be taken to avoid possible shorts to the chassis or other components. The leads should be kept short and straight when possible. Soldering should be done with a great deal of care, so that fluxes will not run over onto adjacent insulation, thus causing leakage and a possible source of trouble.

Components are given code designations so that the identification of parts on both the diagrams and on written matter is easily defined. The switch terminals are numbered in such a manner that if the switch were viewed from the front, the numbering system would progress in a clockwise direction around the switch. The band switch sections are referred to as BF or BR, corresponding to the front and rear sections of the switch when viewed from the shaft end. The tube sockets are also numbered in a clockwise direction, as viewed from the bottom, starting from the gap between the socket terminals. Thus a reference to R4 refers to the number 4 terminal on socket R, counted from the first terminal to the left of the open space between terminals 1 and 9 on that particular socket. In wiring the sub-chassis, reference to Pictorials 1 and 2 will illustrate the placement of all parts and leads.



PICTORIAL 1



PICTORIAL 2

(S) means solder. (NS) means do not solder yet.

( ) Connect a 33 KΩ resistor from TA1 (NS) to TA2 (NS).

( ) Connect a 470 KΩ resistor from TA2 (NS) to R2 (NS).

( ) Connect a 150 μμf (.00015 μfd) ceramic condenser from TA2 (NS) to R2 (NS).

( ) Connect a 10 μμf (.00001 μfd) ceramic condenser from R2 (S) to R6 (NS).

( ) Connect a 1 KΩ resistor from R3 (S) to TA3 (NS).

( ) Connect a 6" length of wire to TA3 (S). Leave the other end free.

( ) Connect a 100 KΩ resistor from TA2 (S) (use sleeving) to the solder lug (NS).

( ) Connect a wire about 9" long to TA1 (S). Run wire as shown in Pictorial 2 through the cable clamp. Leave the other end free.

( ) Connect a wire about 9" long to R4 (NS). Run wire as shown through the cable clamp. Leave the other end free.

( ) Connect a short bare wire from R4 (S) to R5 (NS).

( ) Connect a wire about 4" long to R5 (S). Leave the other end free.

( ) Connect a bare wire from R6 (S) to CC2 (S).

( ) Connect a 33 μμf (.000033 μfd) ceramic condenser from CC1 (S) to R7 (NS).

( ) Connect a 15 KΩ resistor from R7 (S) to the solder lug (NS).

( ) Connect a short bare wire from R8 (S) to the solder lug (NS).

( ) Connect a short bare wire from R9 (S) to the solder lug (S).

( ) Connect a bare wire to R1 (S). Cover with a 2 1/2" length of sleeving. Run wire through hole S to C1 (NS).

( ) Connect a piece of bare wire 7 1/2" long to A1 (S). Slip a 1 7/16" length of sleeving over this wire and run through B1 (S), add a 4 1/2" length of sleeving and run through C1 (S), add a 1 1/8" length of sleeving and connect to D1 (NS).

( ) Connect a short bare wire from BR12 on the band switch (S) to BF12 (S).

( ) Connect a bare wire from BF1 (S) to A2 (S).

( ) Connect a bare wire from BF2 (S) to B2 (S).

( ) Connect a bare wire from BF3 (S) to C2 (S).

( ) Connect a bare wire from BF4 (S) to D2 (S).

( ) Connect a bare wire from BR1 (S) to A3 (S).

( ) Connect a bare wire from BR2 (S) to B3 (S).

(✓) Connect a bare wire from BR3 (S) to C3 (S).

(✓) Connect a bare wire from BR4 (S) to D3 (S).

(✓) Connect coil E3 from BF5 (S) to BR5 (S).

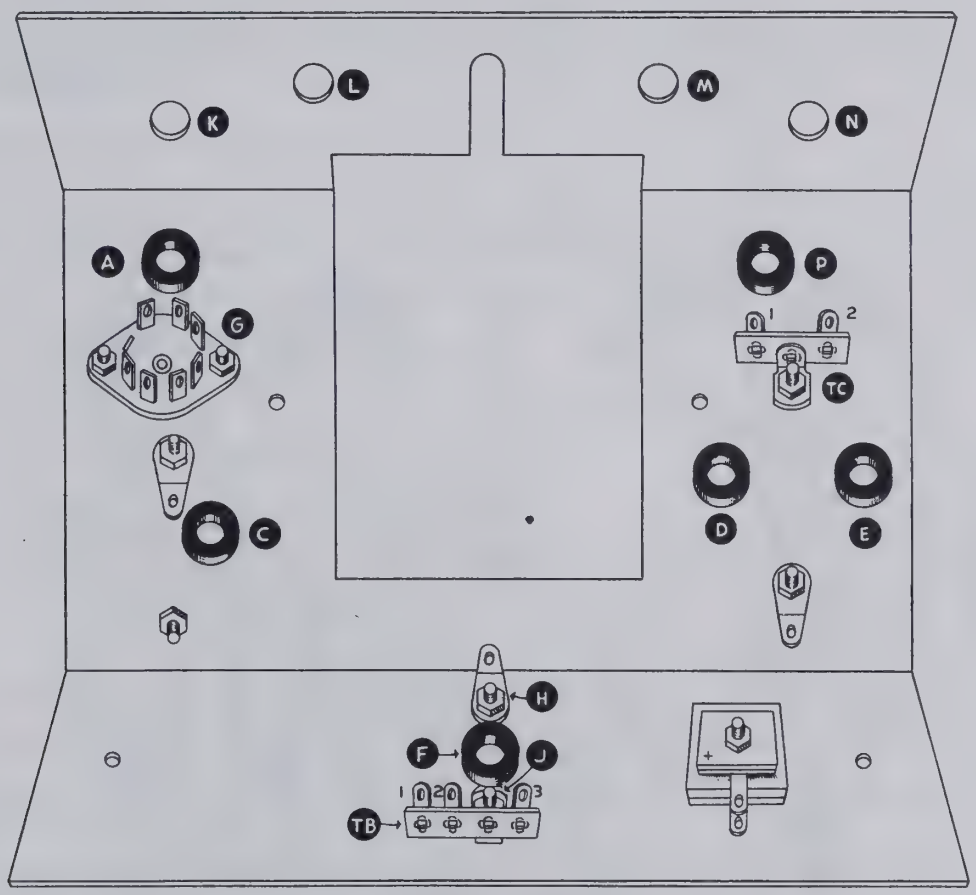
(✓) Cover one bare lead from coil E3 with a 3 1/2" length of sleeving, and connect to D1 (S). Leave the other end free.

(✓) Connect coil E1 from BF6 (S) to CC3 (S).

(✓) Connect coil E2 from BR6 (S) to CC4 (S).

This completes the sub-chassis wiring.

ASSEMBLY OF CHASSIS



NOTE: Refer to Figure 6.

Figure 6

(✓) Install 3/8 rubber grommets in holes A, C, D, E, F and P.

(✓) Mount a 7-pin miniature socket in hole G, using 3-48 screws and nuts. Position as shown in Figure 6.

(✓) Mount the selenium rectifier with the side having the plus or cathode marking facing outward from the back of the chassis. Use a 1" 6-32 screw through the dimpled hole in the rear apron of the chassis. Fasten with a lockwasher and nut. Position as shown in Figure 6.

( ) Mount the audio choke on top of the chassis to the rear of the tube socket. Use 3/8 6-32 screws, placing a solder lug under the nut nearest the tube socket and the lockwasher under the other nut. Position the solder lug as shown in Figure 6.

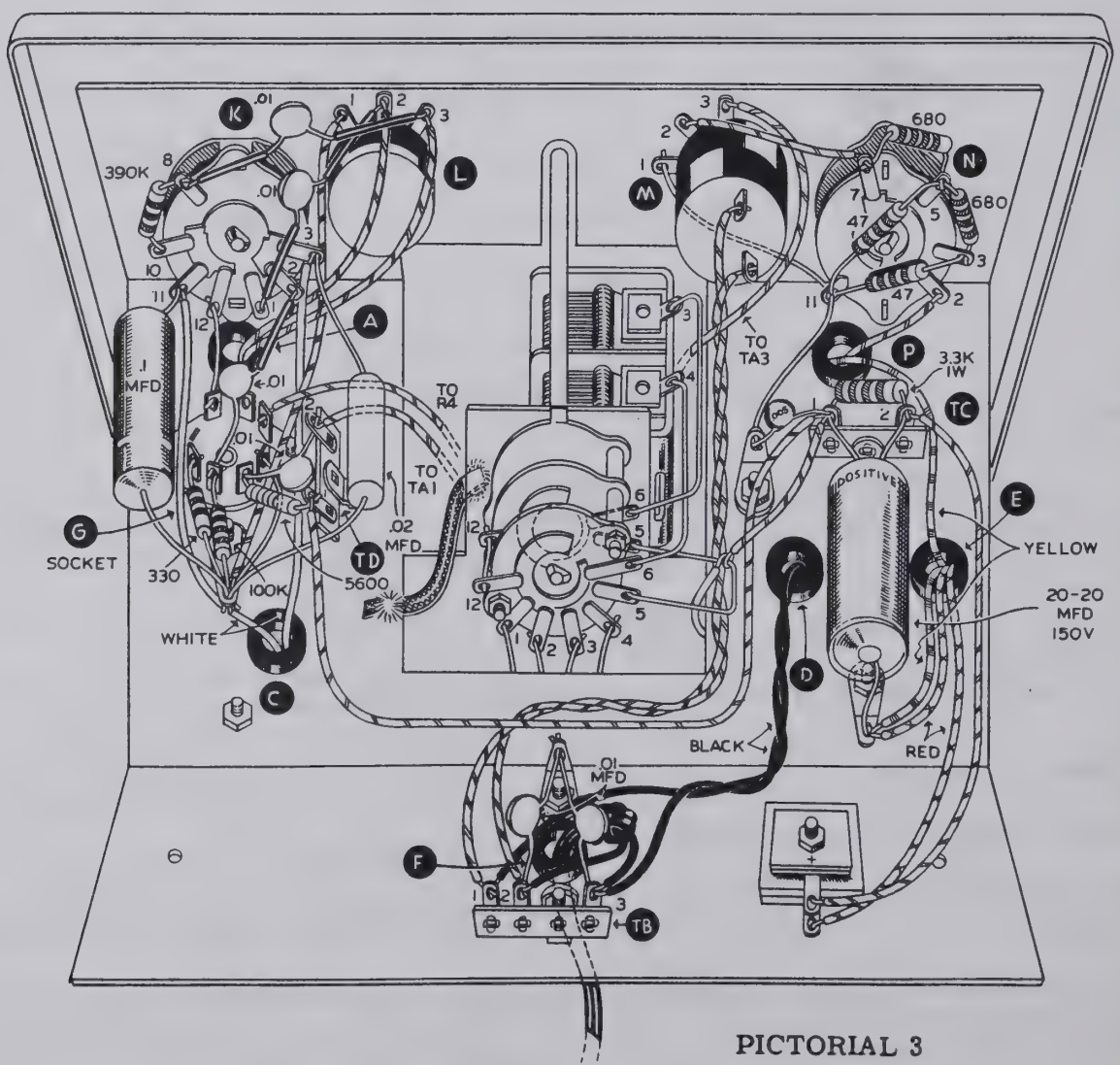
( ) Mount the power transformer on top of the chassis opposite the audio choke. Position the transformer in such a manner that the red and yellow leads pass through the grommet nearest the chassis edge.

( ) On the back mounting screw of the transformer, place a solder lug on the under side of the chassis. Position as shown in Figure 6.

( ) On the front mounting screw, mount a 2-lug terminal strip TC. Position as shown in Figure 6. Use a lockwasher under the nut.

( ) Using 3/8 6-32 screws, mount a solder lug at hole H and a 3-lug terminal strip TB at hole J, using a lockwasher on the latter. Position as shown in Figure 6.

( ) Mount the sub-chassis to the chassis by inserting the sub-chassis spade bolts through the small holes on either side of the large chassis cutout. Care must be taken to prevent damage to the E band coils at this time. Lower the sub-chassis through the hole at a slight angle to clear the E band coils, and at the same time permit the band switch shaft to drop down into the slotted hole in the front of the chassis.



PICTORIAL 3

( ) Referring to Pictorial 3, place a solder lug on the right hand spade bolt as viewed from the bottom, add a 6-32 nut and tighten.

( ) On the left hand spade bolt, place a 2-lug terminal strip TD, a lockwasher and nut. Position as shown in Pictorial 3.

( ) Solder a 1 3/4" length of shield braid directly on the chassis and sub-chassis as shown in Pictorial 3.

( ) Mount the pilot light in the upper right panel hole, as viewed from the front. See Figure 7 for method of mounting.

( ) Mount the three shielded connectors in the holes marked AF IN, AF OUT, and RF OUT. See Figure 8 for method of mounting.

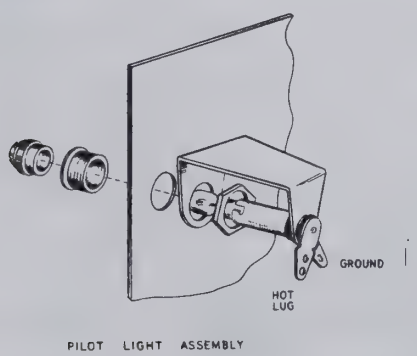
NOTE: The controls are mounted through both the chassis and panel and hold the panel to the chassis. Refer to Figure 5 for method of mounting controls. The controls are lettered the same as the hole markings on Figure 6.

( ) Mount the two position EXT-INT modulation switch in hole K. Position terminals as shown in Pictorial 3.

( ) Mount the 1 megohm potentiometer L in hole L, and position terminals as shown in Pictorial 3.

( ) Mount the 1 KΩ control M in hole M, and position terminals as shown in Pictorial 3.

( ) Mount the three position attenuator switch N in hole N, and position terminals as shown in Pictorial 3.



PILOT LIGHT ASSEMBLY

Figure 7

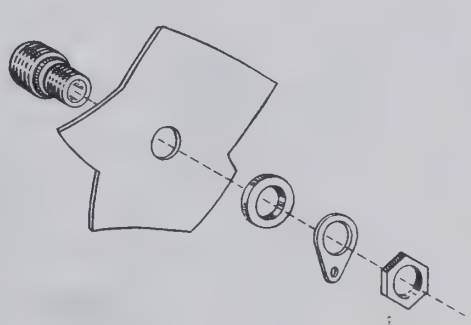


Figure 8

WIRING OF CHASSIS

NOTE: Exercise care when wiring chassis to avoid damage to E band coils.

( ) Twist the two black wires from the power transformer together and connect either wire to TB3 (NS).

( ) Connect the other black wire to TB1 (NS).

( ) Connect a .01 μfd (10,000 μμf) ceramic condenser from TB3 (NS) to the solder lug on the opposite side of hole F (NS).

( ) Connect a .01 μfd ceramic condenser from TB2 (NS) to the same solder lug (S).

( ) Connect either red wire from the transformer to the negative selenium rectifier terminal. (The terminal nearest the chassis.) (S).

( ) Connect the other red wire to the solder lug directly below the rectifier (NS).

( ) Connect either yellow wire from the transformer to this solder lug (NS).

( ) Run the other yellow lead as shown in Pictorial 3, through the grommet P. Leave the other end free.

( ) The 20-20 μfd 150 volt filter condenser has two leads on the end marked "positive," and one lead on the other end. The condenser is mounted between the solder lug and the terminal strip TC as shown in Pictorial 3.

( ) Connect the single negative wire to the solder lug (S).

( ) Connect the two positive wires of the condenser to TC1 and TC2 (NS).

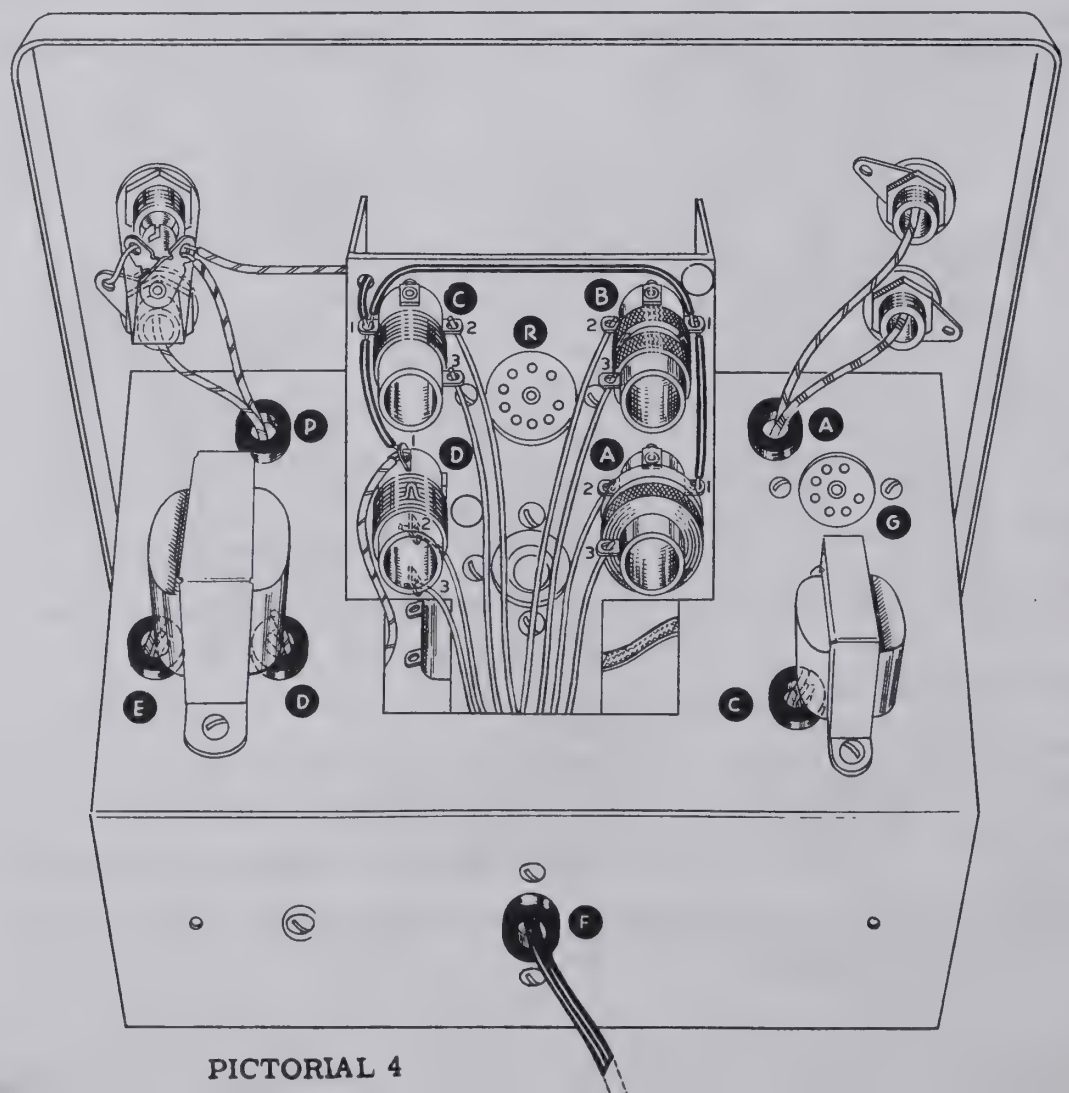
( ) Connect a wire from the positive rectifier terminal (S) to TC2 (NS).

( ) Connect a 3.3 KΩ 1 watt resistor from TC2 (S) to TC1 (NS).

( ) Connect a .005 μfd (5000 μμf) disc ceramic condenser from TC1 (NS) to adjacent solder lug (NS).

( ) Twist two wires about 10" long together. Connect one pair of wire ends to the two switch terminals on the back of control M (S).

( ) Run the wires as shown in Pictorial 3 to the terminal strip TB. Connect one wire to TB1 (S).



PICTORIAL 4

( ) Connect the other wire to TB2 (NS).

( ) Connect a bare wire to M1 (S). Run the wire through N11 (NS) to the solder lug adjacent to the large panel cutout (S).

( ) Connect a 47 Ω resistor from N11 (NS) to N5 (NS).

( ) Connect a 47 Ω resistor from N11 (S) to N3 (NS).

( ) Connect a 680 Ω resistor from N3 (S) to N5 (NS).

( ) Connect a 680 Ω resistor from N5 (S) to N7 (NS).

( ) Connect a bare wire to N7 (S). Cover with a 1 1/2" length of spaghetti and connect to M2 (S).

( ) Connect the free end of the wire coming from TA3 (see Pictorial 2) to M3 (S). Run wire as shown in Pictorial 3.

( ) Connect a bare wire to N2 (S). Cover wire with a 2 1/2" length of spaghetti. Run wire through grommet P and connect to the center terminal of the RF OUT connection (S). See Pictorial 4.

( ) Connect a short bare wire from the lug on the RF OUT connector (S) to the pilot light terminal nearest the panel (S).

( ) Connect the free end of the yellow transformer wire to the rear pilot light terminal (NS).

( ) Connect the free end of the wire coming from R5 (see Pictorial 2) to the same pilot light terminal (S).

( ) Connect the remaining bare wire of coil E3 to TC1 (NS). (Use sleeving.)

( ) Connect a wire to TC1 (S). Run wire along rear of chassis as shown in Pictorial 3, to TD1 (NS).

( ) Connect a short bare wire from G1 (S) to K12 (S).

( ) Connect the free end of the wire coming from R4 (see Pictorial 2) to G3 (S).

( ) Connect the free end of the wire coming from TA1 (see Pictorial 2) to TD2 (NS).

( ) Connect a short bare wire from G4 (S) to the solder lug adjacent to the tube socket (NS).

( ) Connect a .01 μfd ceramic condenser from G5 (NS) to TD2 (S).

( ) Connect a 5600 Ω resistor from G5 (S) to TD1 (S).

( ) Connect a 100 KΩ resistor from G6 (NS) to the solder lug (NS).

( ) Connect a .01 μfd ceramic condenser from G6 (S) to K2 (S). (Use sleeving.)

( ) Connect a 330 Ω resistor from G7 (S) to the solder lug (NS).

( ) Connect a 390 KΩ resistor from K8 (NS) to K10 (S).

( ) Slip a 7/8" length of spaghetti over each lead of the .01 μfd ceramic condenser, and connect the condenser from K8 (S) to L3 (NS).

( ) Connect a wire to L3 (S). Run the wire through the grommet A to the center terminal of the AF IN connector (S). See Pictorial 4.

( ) Connect either lead from the audio choke to K11 (NS).

( ) Connect one lead of a .1 μfd condenser to the solder lug (NS). NOTE: Any "outside foil" or "ground" markings on the paper capacitors can be disregarded in wiring this circuit. They may be connected with either "polarity."

( ) Connect the other lead of this condenser to K11 (S). Position condenser as shown in Pictorial 3.

( ) Slip a 3/4" length of sleeving over each lead of a .01 μfd ceramic condenser. Connect one lead of the condenser to K1 (S). Connect the other lead to L2 (NS).

( ) Connect a wire to L2 (S). Run the wire through the grommet A to the center terminal of the AF OUT connector (S).

( ) Connect a wire from L1 (S) to the solder lug (NS). See Pictorial 3.

( ) Connect the remaining lead from the audio choke to K3 (NS).

( ) Cut one lead of a .02 μfd condenser to 3/4" in length. Connect this lead to K3 (S).

( ) Connect the other lead of this condenser to the solder lug (S).

( ) Insert the line cord through the grommet F in the rear of the chassis. Tie a knot in the cord about 1 1/2" from the end. Connect one lead to TB2 (S).

( ) Connect the other lead to TB3 (S).

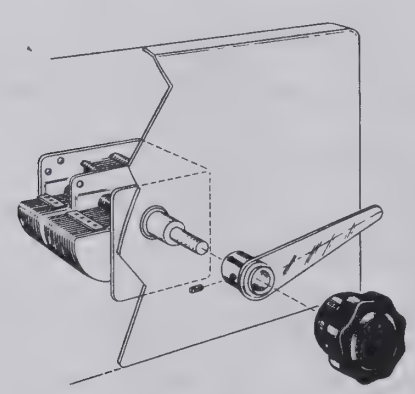


Figure 9

( ) Mount pointer knobs on the five controls at the bottom of the panel. If the pointers do not line up properly with the markings on the panel, remove the knob, loosen the control nut and turn the control slightly until they do line up.

( ) See Figure 9 for details of mounting the tuning controls. The pointer should be adjusted to cover the entire scale when the condenser is rotated.

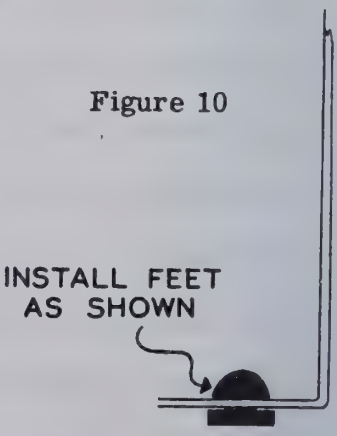
( ) Install the 12AU7 tube in the 9-pin socket on the sub-chassis.

( ) Install the 6C4 tube in the 7-pin socket on the chassis.

( ) Assemble the handle to the cabinet using two 10 x 24 screws.

( ) Install the rubber feet on the cabinet as shown in Figure 10.

Figure 10



( ) Slide the chassis into the cabinet with the line cord through the hole in the back of the cabinet.

( ) Fasten the unit to the cabinet with two #6 sheet metal screws through the back of the cabinet.

This completes the assembly and wiring of your Heathkit model SG-8 Signal Generator.

TEST LEAD ASSEMBLY

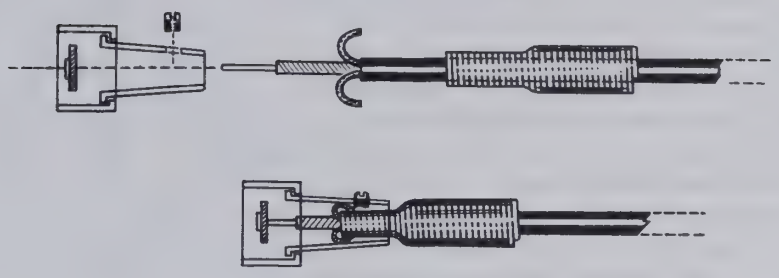


Figure 11

The test lead is assembled as shown in Figure 11. One end of the shielded cable is connected to the shielded plug; the other end has alligator clips mounted on it for connection to the equipment under test. First, remove the spring cable guard from the connector plug by loosening the screw in the side of the plug. Slide this spring over the shielded cable, with the small end of the spring toward the end that is to be connected to the plug. The outside insulation on the cable is then cut back for a length of about 3/4", then flare the shield braiding at the end of the cable so that it may be pushed back over the small end of the spring cable guard. The inner connector is then stripped for a length of approximately 1/8". The assembly at this point is slid back into the connector so that the inner coaxial wire passes through the rivet in the insulated end of the connector, the cable guard with the shielded braid flared over the end is pushed back into the connector and the screw tightened to hold it in place. Solder the inner connector.

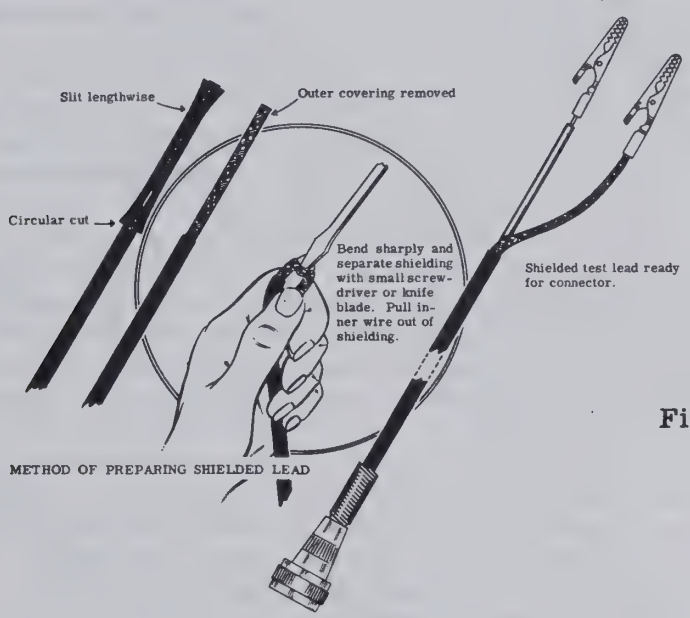


Figure 12

On the other end of the shield cable, the outer insulation is cut back about 4" and the cable prepared as shown in Figure 12. Solder alligator clips to both the inner conductor and the shield braid.

ACCURACY

Any signal generator is designed as a convenient and controllable source of modulated or unmodulated signals. No signal generator is designed as a frequency standard. Expensive standard signal generators have fairly accurate (3 to 20%) attenuators which control the output voltage and the calibration accuracy is rarely closer than 1%. The Heathkit Signal Generator may be expected to fall within 2 to 3% of the frequency calibration, which is quite satisfactory for service work and alignment. In receiver adjustment, the frequency at which the particular adjustment is made is rarely critical but the adjustment itself for maximum signal output from the

receiver is frequently quite critical. For accurate calibration of home built receivers or equipment, proceed as follows. Make a rough calibration with the signal generator. Then, with a receiver, tune in WWV (Bureau of Standards) at 2.5, 5, or 10 mc. Set the signal generator to a suitable sub-harmonic, such as 500 or 1000 kc, and adjust the generator for zero beat. Now harmonics of the signal generator occur every 500 kc or 1 megacycle, and these harmonics may be used to give accurate calibrations at points 500 or 1000 kc apart, such as 2500 kc, 3000 kc, 3500 kc, 4000 kc, etc. These known frequency points can be marked on the dial of the equipment being calibrated. The object of the rough calibration is merely to furnish a means of identifying for example, the 3000 kc point from the 2500 kc or 3500 kc points. For calibration of higher frequency equipment, a choice of higher sub-harmonic will reduce the confusion between the multitude of harmonics and will also insure adequate signal strength. When checking the calibration accuracy of the Heathkit Signal Generator, the most convenient standards of comparison of sufficient accuracy are broadcast stations of known frequency. Crystal oscillators of standard frequency when zero beat against WWV, are also convenient to use if available. The use of receiver dial calibrations is frequently not of sufficient accuracy to warrant consideration.

USE OF THE RF SIGNAL GENERATOR

This signal generator can be used to align radio receivers. It furnishes a source of radio frequency or modulated radio frequency by means of signal generator fundamental frequencies between 160 kc and 100 megacycles (1 megacycle equals 1000 kilocycles) and useful harmonics of the signal generator may be used to over 200 megacycles.

Wherever possible, the recommendations of the manufacturer of the radio being aligned should be used. When this information is not available, the following procedure can be used.

Output Indications: With the new types of receivers, especially those using AVC (automatic volume control) a visual means of indicating resonance is desirable. If convenient, in all receiver alignments the AVC should be disabled during the process of alignment, otherwise the output of the signal generator should be sufficiently attenuated to prevent AVC operation in the receiver.

IF Alignment: Connect the signal generator shield to chassis (ground clip). Clip the hot lead from the signal generator to the control grid terminal on the converter or mixer tube socket. Set the signal generator to the IF frequency required. RMA standard is 455 kc but other frequencies like 262 and 175 kc are sometimes used. Adjust the generator output for a minimum readable output indication. Adjust IF transformers starting with the one nearest the second detector and working forward. The adjustment mechanism consists generally of two screws which operate trimmer condensers or iron cores inside the coils. They may be located on top, on the side, or on the top and bottom of the IF transformer. Turn the adjusting screw for maximum output, reducing the signal generator output if necessary to keep the output indicator from going off scale.

Oscillator Alignment: With the generator connected as above, set the generator dial to the highest frequency marked on the receiver dial. (1600 or 1720 kc.) Set the receiver dial to this same frequency. Adjust the receiver oscillator trimmer to bring in the signal. An additional adjustment is often provided in the form of a padding condenser or iron core. This is generally adjusted at 600 kc and its final adjustment is made later.

RF Alignment: Using a 200 $\mu\mu$f condenser between generator and antenna post, set receiver and generator to 1400 kc. Adjust antenna and RF trimmer (if used), (frequently located on the tuning condenser) for maximum output. Set generator to 600 kc and "rock" tuning condenser through the signal while adjusting the oscillator padder for maximum output at resonance.

For receivers with a loop antenna, couple the signal through a single turn loop connected to the generator output. Tuned radio frequency receivers are aligned as shown under "RF Alignment."

The AF output source can be used to test audio amplifiers. To make such tests, connect the test lead to the AF OUT jack and throw the modulation switch to INT position. Connect the alligator clip on the ground lead from the generator to the chassis of the amplifier under test. The

alligator clip on the hot lead from the generator is then touched to the grid (through a .05 μfd condenser) of the audio stage under test. This should produce an audible output of approximately 400 cycles if the stage is operating correctly and is connected to a good speaker.

Output Voltage: The RF signal strength going into the output control depends upon the strength of oscillation of the 12AU7 oscillator. In all variable frequency oscillators the amplitude will vary with the tuning condenser setting. With careful design the variation may be minimized. In the Heathkit Signal Generator, the variation is kept down to a ratio of about 2 1/2 to 1 on each band except band E, where the L/C (inductance to capacitance) ratio becomes sufficiently unfavorable that oscillation may drop off rapidly in strength when the condenser is near maximum capacity. However, even on this band, the output of the SG-8 is in excess of 100,000 microvolts which is more than sufficient for the average application in which this generator will be used.

IN CASE OF DIFFICULTY

1. Recheck the entire wiring. Follow each lead and color it on the pictorial with a colored pencil. If possible, have a friend recheck the wiring for you. Most cases of difficulty result from wrong or reversed connections. In this unit, there is also the possibility of shorts to the chassis occurring on some of the bare wire connections from the coils. These wires should be carefully spaced away from the chassis when the instrument is assembled.
2. Check the test lead with an ohmmeter to be sure there are no shorts between the inner and outer conductor caused by overheating during the soldering process.
3. If the wiring is found to be correct and the signal generator still refuses to work, try changing tubes. It is possible that one of the tubes is defective.
4. Check the voltages. A voltage chart is included showing the normal voltage to be expected at the pins of the tube sockets. These voltages were measured with an 11 megohm input vacuum tube voltmeter. A normal variation of ±15% is to be expected. With regular voltmeters, readings may be very much lower. All voltages are DC unless otherwise indicated.
5. If only one band on the signal generator is inoperative, it is very likely that the coil associated with that band has become damaged. An ohmmeter connected between the terminals of the coil should show continuity. If it does not, one section of the winding is open.

VOLTAGE CHART

TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
6C4	65	NC	6.3 AC	0	65	-0.5	1		
12AU7	78	*-2 to -15	3.5	6.3 AC	6.3 AC	*75-85	*-3 to -30	0	0

*Dependent upon frequency.
NC - no connection.

REPLACEMENTS

Material supplied with Heathkits has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty tube or component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information:

A. Thoroughly identify the part in question by using the part number and description found in the manual parts list.
B. Identify the type and model number of kit in which it is used.
C. Mention the order number and date of purchase.
D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. Please do not return the original component until specifically requested to do so. Do not dismantle the component in question as this will void the guarantee. If tubes are to be returned, pack them carefully to prevent breakage in shipment as broken tubes are not eligible for replacement. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SERVICE

In event continued operational difficulties of the completed instrument are experienced, the facilities of the Heath Company Service Department are at your disposal. Your instrument may be returned for inspection and repair for a service charge of $3.00 plus the cost of any additional material that may be required. THIS SERVICE POLICY APPLIES ONLY TO COMPLETED INSTRUMENTS CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Instruments that are not entirely completed or instruments that are modified in design will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned not repaired.

The Heath Company is willing to offer its full cooperation to assist you in obtaining the specified performance level in your instrument. Factory repair service is available for a period of one year from the date of purchase or you may contact the Engineering Consultation Department by mail. For information regarding the possible modification of existing kits, the volumes listed in the Bibliography section are recommended. They can be obtained at or through your local library, as well as at any electronic outlet store. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for specific purposes. Therefore, such modifications must be made at the discretion of the kit builder according to information which will be much more readily available from some local source.

SHIPPING INSTRUCTIONS

Before returning a unit for service, be sure that all parts are securely mounted. Attach a tag to the instrument giving name, address and trouble experienced. Pack in a rugged container, preferably wood, using at least three inches of shredded newspaper or excelsior on all sides. DO NOT SHIP IN THE ORIGINAL KIT CARTON AS THIS CARTON IS NOT CONSIDERED ADEQUATE FOR SAFE SHIPMENT OF THE COMPLETED INSTRUMENT. Ship by prepaid express if possible. Return shipment will be made by express collect. Note that a carrier cannot be held liable for damage in transit if packing, in HIS OPINION, is insufficient.

SPECIFICATIONS

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

WARRANTY

The Heath Company limits its warranty of parts supplied with any kit to a period of three (3) months from the date of purchase. Replacement will be made only when said part is returned postpaid, with prior permission and in the judgment of the Heath Company was defective at the time of sale. This warranty does not extend to any Heathkits which have been subjected to misuse, neglect, accident and improper installation or applications. Material supplied with a kit

shall not be considered as defective, even though not in exact accordance with specifications, if it substantially fulfills performance requirements. This warranty is not transferable and applies only to the original purchaser. This warranty is in lieu of all other warranties and the Heath Company neither assumes nor authorizes any other person to assume for them any other liability in connection with the sale of Heathkits.

The assembler is urged to follow the instructions exactly as provided. The Heath Company assumes no responsibility for the operation of the completed instrument, nor liability for any damages or injuries sustained in the assembly or operation of the device.

HEATH COMPANY
Benton Harbor, Michigan

BIBLIOGRAPHY

Marcus and Levy; Elements of Radio Servicing
Kiver, Milton S.; How to Understand and Use TV Test Instruments
Johnson, J. Richard; How to Use Signal and Sweep Generators

PARTS LIST

PART No.	PARTS Per Kit	DESCRIPTION
Resistors		
1-1	2	47 Ω
1-4	1	330 Ω
1-7	2	680 Ω
1-9	1	1 KΩ
1-3A	1	3.3 KΩ 1 watt
1-18	1	5600 Ω
1-21	1	15 KΩ
1-24	1	33 KΩ
1-26	2	100 KΩ
1-32	1	390 KΩ
1-33	1	470 KΩ
Condensers		
21-3	1	10 μμf (.00001 μfd)
21-7	1	33 μμf (.000033 μfd)
21-11	1	150 μμf (.00015 μfd)
21-16	6	.01 μfd
21-27	1	.005 μfd (5000 μμf)
23-8	1	.02 μfd
23-28	1	.1 μfd
25-7	1	20-20 μfd 150 v
26-17	1	450 μμf dual tuning
Controls-Switches		
10-32	1	1 megohm control
19-18	1	1 KΩ control with switch
63-67	1	5 position band switch
63-69	1	2 position modulation switch
63-70	1	3 position attenuator switch
Coils-Chokes-Transformers		
40-47A	1	Oscillator coil band A
40-47B	1	Oscillator coil band B
40-47C	1	Oscillator coil band C
40-47D	1	Oscillator coil band D
40-47E	1	Oscillator coil band E
46-1	1	AF choke
54-2	1	Power transformer
Tubes-Lamps-Rectifiers		
57-2	1	Selenium rectifier
411-4	1	6C4 tube
411-25	1	12AU7 tube
412-1	1	#47 pilot light
Grommets-Feet-Terminal Strips		
73-1	6	3/8 grommet
261-1	4	Rubber feet
431-2	2	2-lug terminal strip
431-3	2	3-lug terminal strip

PART No.	PARTS Per Kit	DESCRIPTION
Sockets-Knobs-Jacks		
100-M10	1	Indicator assembly
432-3	3	Shielded connector
434-15	1	7-pin miniature socket
434-16	1	9-pin miniature socket
252-12	1	Pilot light nut
413-1	1	Pilot light jewel
434-22	1	Pilot light socket
455-1	1	Pilot light bushing
462-18	1	Skirtless knob
462-19	5	Skirted knob
Hardware		
250-2	4	3-48 x 1/4 screw
250-7	3	6-32 x 3/16 screw
250-8	2	#6 x 3/8 sheet metal screw
250-9	8	6-32 x 3/8 screw
250-13	1	6-32 x 1 screw
250-15	1	8-32 x 1/8 set screw
250-19	2	10-24 x 3/8 handle screw
250-43	6	Set screw
251-1	2	6-32 spade bolt
252-1	4	3-48 nut
252-3	20	6-32 nut
252-7	5	Control nut
253-10	4	Control nickel washer
253-22	3	3/4 flat washer
254-1	17	#6 lockwasher
254-4	5	Control lockwasher
259-1	5	#6 solder lug
Clips-Plugs-Wire		
89-1	1	Line cord
207-3	1	1/8" cable clamp
260-1	2	Alligator clip
340-2	1	length #20 bare wire
343-1	1	length Shielded test lead
344-1	1	roll Hookup wire
345-1	1	length Shield braid
346-1	1	length Spaghetti
432-1	1	Shielded plug
Chassis-Panel-Manual		
90-14	1	Cabinet
200-M54	1	Chassis
200-M55	1	Sub-chassis
203-26F67	1	Panel
211-1	1	Handle
595-73	1	Instruction Manual

HELPFUL KIT BUILDING INFORMATION

Before attempting actual kit construction read the construction manual through thoroughly to familiarize yourself with the general procedure. Note the relative location of pictorials and pictorial inserts in respect to the progress of the assembly procedure outlined.

This information is offered primarily for the convenience of novice kit builders and will be of definite assistance to those lacking thorough knowledge of good construction practices. Even the advanced electronics enthusiast may benefit by a brief review of this material before proceeding with kit construction. In the majority of cases, failure to observe basic instruction fundamentals is responsible for inability to obtain desired level of performance.

RECOMMENDED TOOLS

The successful construction of Heathkits does not require the use of specialized equipment and only basic tools are required. A good quality electric soldering iron is essential. The preferred size would be a 100 watt iron with a small tip. The use of long nose pliers and diagonal or side cutting pliers is recommended. A small screw driver will prove adequate and several additional assorted screw drivers will be helpful. Be sure to obtain a good supply of rosin core type radio solder. Never use separate fluxes, paste or acid solder in electronic work.

ASSEMBLY

In the actual mechanical assembly of components to the chassis and panel, it is important that the procedure shown in the manual be carefully followed. Make sure that tube sockets are properly mounted in respect to keyway or pin numbering location. The same applies to transformer mountings so that the correct transformer color coded wires will be available at the proper chassis opening.

Make it a standard practice to use lock washers under all 6-32 and 8-32 nuts. The only exception being in the use of solder lugs—the necessary locking feature is already incorporated in the design of the solder lugs. A control lock washer should always be used between the control and the chassis to prevent undesirable rotation in the panel. To improve instrument appearance and to prevent possible panel marring use a control flat nickel washer under each control nut.

When installing binding posts that require the use of fiber insulating washers, it is good practice to slip the shoulder washer over the binding post mounting stud before installing the mounting stud in the panel hole provided. Next, install a flat fiber washer and a solder lug under the mounting nut. Be sure that the shoulder washer is properly centered in the panel to prevent possible shorting of the binding post.

WIRING

When following wiring procedure make the leads as short and direct as possible. In filament wiring requiring the use of a twisted pair of wires allow sufficient slack in the wiring that will permit the twisted pair to be pushed against the chassis as closely as possible thereby affording relative isolation from adjacent parts and wiring.

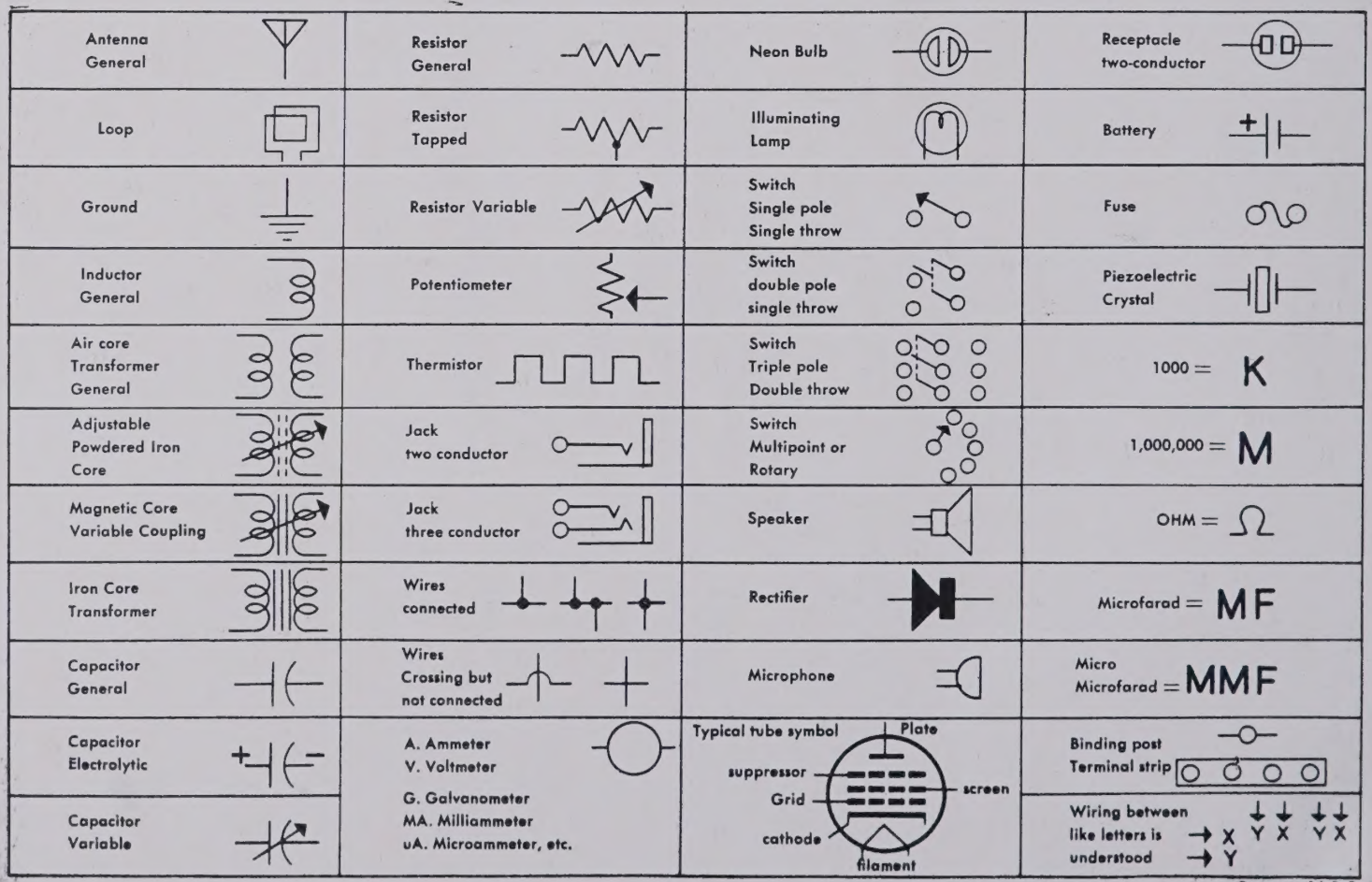
When removing insulation from the end of hookup wire, it is seldom necessary to expose more than a quarter inch of the wire. Excessive insulation removal may cause a short circuit condition in respect to nearby wiring or terminals. In some instances, transformer leads of solid copper will have a brown baked enamel coating. After the transformer leads have been trimmed to a suitable length, it is necessary to scrape the enamel coating in order to expose the bright copper wire before making a terminal or soldered connection.

In mounting parts such as resistors or condensers, trim off all excess lead lengths so that the parts may be installed in a direct point-to-point manner. When necessary use spaghetti or insulated sleeving over exposed wires that might short to nearby wiring.

It is urgently recommended that the wiring dress and parts layout as shown in the construction manual be faithfully followed. In every instance, the desirability of this arrangement was carefully determined through the construction of a series of laboratory models.

SOLDERING

Much of the performance of the kit instrument, particularly in respect to accuracy and stability, depends upon the degree of workmanship used in making soldered connections. Proper soldered connections are not at all difficult to make but it would be advisable to observe a few precautions. First of all before a connection is to be soldered, the connection itself should be clean and mechanically strong. Do not depend on solder alone to hold a connection together. The tip of the soldering iron should be bright, clean and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joint. Avoid excessive use of solder and do not allow a flux flooding condition to occur which could conceivably cause a leakage path between adjacent terminals on switch assemblies and tube sockets. This is particularly important in instruments such as the VTVM, oscilloscope and generator kits. Excessive heat will also burn or damage the insulating material used in the manufacture of switch assemblies. Be sure to use only good quality rosin core radio type solder.



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